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Original Article

A comparative evaluation of the effect of liners on the shear bond strength of veneered zirconia block: An in vitro study

¹Dr. Pramod S Ingaleshwar, ²Dr. Nikhil Soni, ³Dr. Tanvi Kohli, ⁴Dr. Nidhi Manhas, ⁵Dr. Mrinal Kalthuria, ⁶Dr. Sulekha Manhas

¹Reader, Department of Oral Pathology, PMNM Dental College, Bagalkot, Karnataka, India;

²Senior Lecturer, Department of Conservative Dentistry and Endodontics, V.Y.W.S Dental College and Hospital, Amravati, Maharashtra, India;

³3yr PG, Department of Conservative Dentistry and Endodontics, Swami Devi Dyal Hospital and Dental College, Haryana India;

⁴Department of Conservative Dentistry and Endodontics, Swami Devi Dyal Hospital and Dental College, Haryana India;

^{5,6}Department of Pedodontics Dentistry and Preventive Dentistry, Swami Devi Dyal Hospital and Dental College, Haryana India

ABSTRACT:

Background: All ceramic dental restorations composed of porcelain veneer on a zirconia substructure are nowadays being commonly used as an alternative to metal ceramic restorations. The present study was conducted to assess effect of liners on the shear bond strength of veneered zirconia block. **Materials & Methods:** 60 samples were fabricated from VITA zirconia discs. Samples were divided into 4 groups. Each group consisted of 15 samples each. Group I was lithium disilicate glass-ceramic liner group, group II was silicon dioxide based liner, group III was glass-ceramic interlayer group and group IV was control group. SBS of samples was recorded using universal testing machine. Samples were further determined for fractographic behavior using scanning electron microscope. **Results:** The mean shear bond strength in group I was 62.4 Mpa, in group II was 62.2 Mpa, in group III was 36.8 Mpa and in group IV was 24.7 Mpa. The difference was significant ($P < 0.05$). **Conclusion:** The maximum adhesive failures were found with lithium disilicate liner. The maximum shear bond strength was obtained for lithium disilicate liner.

Key words: ceramic dental restorations, shear bond strength, Porcelain

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Corresponding Author: Dr. Pramod S Ingaleshwar, Reader, Department of Oral Pathology, PMNM Dental College, Bagalkot, Karnataka, India

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INTRODUCTION

All ceramic dental restorations composed of porcelain veneer on a zirconia substructure are nowadays being commonly used as an alternative to metal ceramic restorations. Chipping and fracturing of layered porcelain applied to zirconia frameworks continue to be a problem with a reported incidence between 0%-30%. Type of fracture can be adhesive or cohesive.¹ Zirconia surface can be layered with two commercially available glass ceramic that is feldspathic porcelain or feldspathic porcelain with

leucite crystal. Use of interlayer liquid suspension of ceramics as liner between zirconia substructure and veneered porcelain can enhance bond strength to great extension.²

Liners can have a significant effect on the shear bond strength of veneered zirconia blocks. The purpose of using liners is to enhance the bonding between the veneering material and the zirconia block, which can improve the overall strength and durability of the restoration.³ There are several types of liners that can be used, including silica-based and phosphate-based

liners. Silica-based liners typically contain a high percentage of silica, which can improve the bond strength of the veneering material to the zirconia block. Phosphate-based liners, on the other hand, contain phosphoric acid, which can chemically bond to the zirconia surface and improve the adhesion of the veneering material.⁴ Bond strength evaluation of layered porcelain over zirconia substructure can be done using shear bond strength test, three and four points flexure, tensile and microtensile bond test. Shear bond tests have been reported as one of the most established bond strength tests in literature.⁵ SBS measurements showed that veneering porcelain on zirconia with lithium disilicate glass-ceramic liner fired at 85°C had the highest mean SBS.⁶ The present

study was conducted to assess effect of liners on the shear bond strength of veneered zirconia block.

MATERIALS & METHODS

The present invitro study comprised of 60 samples were fabricated from VITA zirconia discs. Samples were divided into 4 groups. Each group consisted of 15 samples each. Group I was lithium disilicate glass-ceramic liner group, group II was silicon dioxide based liner, group III was glass-ceramic interlayer group and group IV was control group. SBS of samples was recorded using universal testing machine. Samples were further determined for fractographic behavior using scanning electron microscope (SEM). Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of specimens

Groups	Group I	Group II	Group III	Group IV
Method	lithium disilicate glass-ceramic liner	silicon dioxide based liner	glass-ceramic interlayer	Control
Number	15	15	15	15

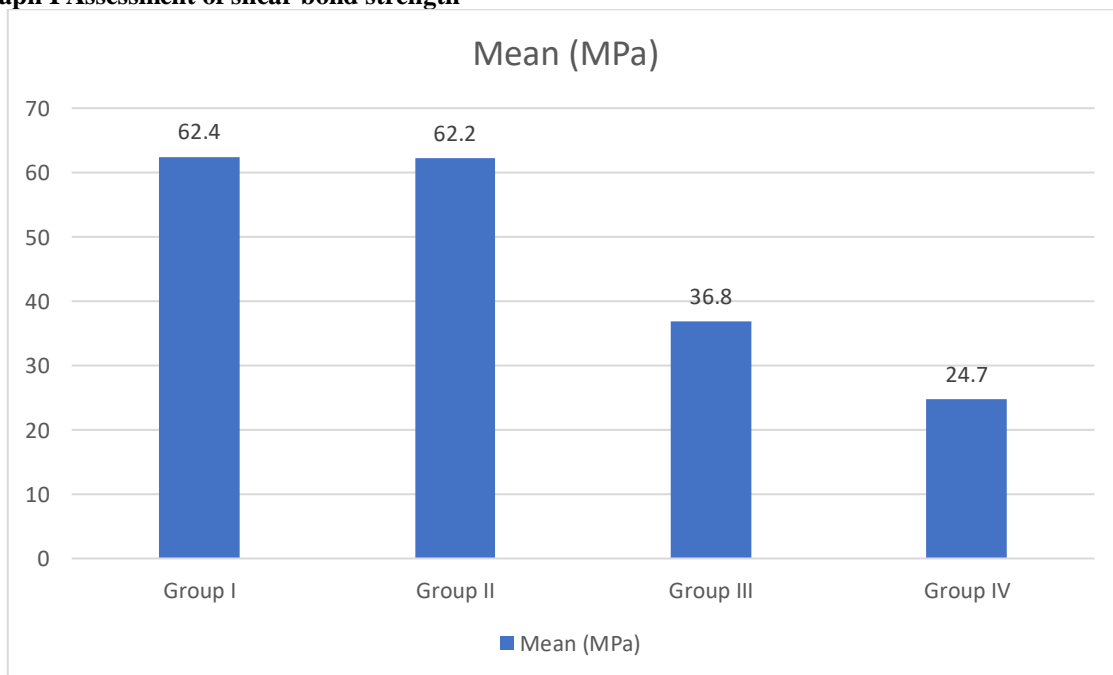
Table I shows distribution of specimens in 4 groups. Each group had 15 specimens.

Table II Assessment of shear bond strength

Groups	Mean (MPa)	P value
Group I	62.4	0.01
Group II	62.2	
Group III	36.8	
Group IV	24.7	

Table II, graph I shows that mean shear bond strength in group I was 62.4 Mpa, in group II was 62.2 Mpa, in group III was 36.8 Mpa and in group IV was 24.7 Mpa. The difference was significant (P< 0.05).

Graph I Assessment of shear bond strength



DISCUSSION

The porcelain-fused-to-metal systems have been extensively used in fixed partial dentures and still

represents the gold standard.⁷ The advantages of the PFM systems are to combine the fracture resistance of the metal substructure with the aesthetic property of

the porcelain.^{8,9} However, recently the increasing demand for aesthetic restorations as well as the questionable biocompatibility of some dental metal alloys has accelerated the development and improvement of metal-free restorations.¹⁰ It is important to note, however, that the type of liner used and the application technique can also affect the bond strength. Therefore, it is recommended to follow the manufacturer's instructions and consult with a dental professional for proper selection and application of the liner.^{11,12} The present study was conducted to assess effect of liners on the shear bond strength of veneered zirconia block.

We found that mean shear bond strength in group I was 62.4 Mpa, in group II was 62.2 Mpa, in group III was 36.8 Mpa and in group IV was 24.7 Mpa. Fischer et al¹³ concluded that the bond strength between zirconia and the veneering ceramic was higher than the cohesive strength of the veneering ceramic. In other words, the weakest link was not the interface but the veneering ceramic itself. Cheng et al¹⁴ assessed the influence of the parameters of blasting on the shear bond strength between zirconia and pressed veneer ceramics. Zirconia was blasted with different alumina particle size subjected to two types of applied pressures. Heat-pressed and layered veneer ceramic blocks were served as an experimental group and control group, respectively. The results indicated that the surface roughness was increased significantly with increasing particle size of alumina and blasting pressure. The alumina particle size had statistically significant influence on shear strength of heat-pressed groups. Among heat-pressed ceramic specimens, the highest and lowest shear strength could be obtained when 50 µm of alumina was used at pressure of 0.3 MPa and 110 µm of alumina was used at 0.5 MPa, respectively.

Al-Dohan et al¹⁵ demonstrated that most of the studies that performed macro shear bond test showed that most fractures occurred in the veneering layer (cohesive failure). The SBS of veneering ceramics was higher than SBS between core and veneering ceramics, and the failure mode observed was mainly combined as adhesive at the interface and cohesive in the veneering ceramic. Yadav et al¹⁶ determined the effect of lithium disilicate glass-ceramic liner, silicon dioxide based liner, and glass-ceramic interlayer on the shear bond strength (SBS) of a commercially available veneered zirconia block. 60 samples were fabricated from VITA (vita zahnfabrik. Bad sackingen, Germany) zirconia discs. Samples were divided into 4 groups with 15 samples each. First is the control group, second is lithium disilicate glass-ceramic liner group, third is silicon dioxide based liner, and fourth is glass-ceramic interlayer group. SBS of samples was recorded using universal testing machine. The mean SBS (Mpa) was significantly more among lithium disilicate and glass-ceramic interlayer groups in comparison to silicon dioxide-based liner group. The limitation the study is small sample size.

CONCLUSION

Authors found that the maximum adhesive failures were found with lithium disilicate liner. The maximum shear bond strength was obtained for lithium disilicate liner.

REFERENCES

1. Komine F, Strub JR, Matsumura H. A bonding between layering materials and zirconia frameworks. *Jpn Dent Sci Rev* 2012;48:153-61.
2. Wattanasirmit K, Srimeepong V, Kanchanatawewat K, Monmaturapoj N, Thunyakitpisal P, Jinawath S. Improving shear bond strength between feldspathic porcelain and zirconia substructure with lithium disilicate glass-ceramic liner. *Dent Mater J* 2015;34:302-9.
3. Bona AD, Pecho OE, Alessandretti R. Zirconia as a dental biomaterial. *Materials (Basel)* 2015;8:4978-91.
4. Subash M, Vijitha D, Deb S, Satish A, Mahendirakumar N. Evaluation of shear bond strength between zirconia core and ceramic veneers fabricated by pressing and layering techniques: In vitro study. *Journal of pharmacy & bioallied sciences*. 2015 Aug;7(Suppl 2):S612.
5. Dündar M, Ozcan M, Cömlekoglu E, Güngör MA, Artunç C. Bond strengths of veneering ceramics to reinforced ceramic core materials. *Int J Prosthodont*. 2005;18:71-72.
6. L. Hallmann, P. Ulmer, E. Reusser, C.H.F. Hämmerle. Effect of blasting pressure, abrasive particle size and grade on phase transformation and morphological change of dental zirconia surface *Surf Coat Technol* 2012;4293-4302.
7. Saito A, Komine F, Blatz MB, Matsumura H. A comparison of bond strength of layered veneering porcelains to zirconia and metal. *J Prosthet Dent* 2010;104:247-57.
8. Miyazaki T, Nakamura T, Matsumura H, Ban S, Kobayashi T. Current status of zirconia restoration. *J Prosthodont Res* 2013;57:236-61.
9. Rismanchian M, Shafiei S, Askari N, Khodaeian N. Comparison of shear bond strength of two veneering ceramics to zirconia. *Dent Res J (Isfahan)* 2012;9:628-33.
10. Smith TB, Kelly JR, Tesk JA. *In vitro* fracture behavior of ceramic and metal-ceramic restorations. *J Prosthodont*. 1994;3:138-44.
11. Ishibe M, Raigrodski AJ, Flinn BD, Chung KH, Spiekerman C, Winter RR. Shear bond strengths of pressed and layered veneering ceramics to high-noble alloy and zirconia cores. *J Prosthet Dent*. 2011;106:29-37.
12. Fischer J, Grohmann P, Stawarczyk B. Effect of zirconia surface treatments on the shear strength of zirconia/veneering ceramic composites. *Dent Mater J*. 2008;27:448-54.
13. Choi BK, Han JS, Yang JH, Lee JB, Kim SH. Shear bond strength of veneering porcelain to zirconia and metal cores. *J Adv Prosthodont*. 2009;1:129-35.
14. Cheng CW, Yang CC, Yan M. Bond strength of heat-pressed veneer ceramics to zirconia with various blasting conditions. *Journal of dental sciences*. 2018 Dec 1;13(4):301-10.
15. Al-Dohan HM, Yaman P, Dennison JB, Razzoog ME, Lang BR. Shear strength of core-veneer interface in bilayered ceramics. *J Prosthet Dent*. 2004;91:349-55.

16. Yadav P, Dabas N, Phukela SS, Malhotra P, Drall S, Ritwal PK. A comparative evaluation of the effect of liners on the shear bond strength of veneered zirconia block: An in vitro study. *The Journal of the Indian Prosthodontic Society*. 2019 Oct;19(4):338.